Neural differentiation of human umbilical cord matrix-derived mesenchymal cells under special culture conditions

ABSTRACT

Many neural disorders are characterized by the loss of one or several types of neural cells. Human umbilical cord-derived mesenchymal cells (hUCMs) are capable of differentiating into neuron, astroglia-like and oligodendrocyte cell types. However, a reliable means of inducing the selective differentiation of hUCMs into neural cells in vitro has not yet been established. For induction of neural differentiation, hUCMs were seeded onto sterile glass slides and six various cocktails using a base medium (DMEM/LG) supplemented with 10 % FBS, retinoic acid (RA), dimethyl sulfoxide (DMSO), epidermal growth factor (EGF) and fibroblast growth factor (FGF) were used to compare their effect on neuronal, astrocyte and oligodandrocyte differentiation. The hUCMs were positive for mesenchymal markers, while they were negative for hematopoietic markers. Differentiation to adipogenic and osteogenic lineage was detected in these cells. Our data revealed that the cocktail consisting of DMEM/LG, FBS, RA, FGF, and EGF (DF/R/Fg/E group) induced hUCM cells to express the highest percentage of nestin, ß-tubulin III, neurofilament, and CNPase. The DF/Ds/Fg/E group led to the highest percentage of GFAP expression. While the expression levels of NF, GFAP, and CNPase were the lowest in the DF group. The least percentage of nestin and ß-tubulin III expression was observed in the DF/Ds group. We may conclude that FGF and EGF are important inducers for differentiation of hUCMs into neuron, astrocyte and oligodendrocyte. RA can induce hUCMs to differentiate into neuron and oligodendrocyte while for astrocyte differentiation DMSO had a pivotal role.

Keyword: Differentiation; Dimethyl sulfoxide; Neural cells; Retinoic acid; Umbilical cord; Mesenchymal cells; Wharton's jelly